

Secondary School Students' Hopes and Goals for STEM Education

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Abstract: The STEM education concept, abbreviated to the initials of science, technology, mathematics, and engineering disciplines, is one of the key approaches on the agenda of many countries. The past literature on the subject indicates that STEM education has positive effects on 21st-century skills such as critical thinking, problem-solving, and scientific creativity. Hence, this study aims to evaluate secondary school students' hopes and goals for STEM education in terms of various variables. The data of the research, which was designed using the surveying model as one of the quantitative research methods, were collected from secondary school students with the "Hopes and Goals Survey for STEM Education". The findings obtained as a result of the research analyzes were discussed based on the literature, and some relevant suggestions were given.

Keywords: STEM education, hopes and goals, secondary school student

Introduction

STEM education is a trend approach that focuses on science, technology, mathematics, and engineering disciplines and has recently been on the agenda of many countries. Countries that want to lead in the economy, industry, and military, especially the USA and China, have made remarkable reforms in their education systems (Breiner et al., 2012). A huge number of resources have been created in this sense (Dennon, 2021) since these countries know the importance of having individuals with productive, creative, critical and problem-solving skills. To that end, STEM education plays a fundamental role in the development of 21st-century skills (Bybee, 2013).

There are different definitions of STEM education. In general, STEM education is an integrated approach that includes formal and informal education processes from preschool to higher education (Gonzalez & Kuenzi, 2012), aims to develop 21st-century skills, and puts the student at the center (Bybee, 2013; Morrison, 2006). The main purposes of STEM education are explained by Thomas (2014) with the following four items:

1. Labor force with STEM literacy
2. Maintaining existing jobs in the disciplines of STEM
3. Developing innovative products that provide economic value for countries
4. Training skillful individuals for tomorrow's business areas

In addition to academic achievement, STEM education aims to keep the countries' economies strong and have a say in international competition (Hebebe, 2019). Moreover, it is vital for STEM education to raise qualified individuals to produce innovations that provide an economic advantage for these countries and keep up with the times (Eroğlu & Bektaş, 2016).

Studies on STEM education in the literature are continuously increasing (Chiang et al., 2022; Godec et al., 2022; Li et al., 2020; Wan et al., 2021). However, there is a limited number of studies related to the hopes and goals of STEM education (Douglas & Strobel, 2015; Timur et al., 2022; Yaman et al., 2019). These studies are usually based on scale development and adaptation research. Besides, secondary school is a period in which individuals' professional preferences are formed (Hirsch et al., 2007; Knight & Cunningham, 2004). Thus, there is a need to examine the hopes and goals in the context of STEM education (Douglas & Strobel, 2015). The level of hope of students contributes to academic achievement (Ciarrochi et al., 2007; Snyder et al., 2002). Hence, it is important to determine the goals and objectives of students for STEM education.

Problem and Sub-Problems

The research question of this study is “What are the hope and goal levels of secondary school students for STEM education?”

1. What are the professional tendencies of the students regarding STEM disciplines?
2. Do students' hope and goal levels for STEM education differ by gender?
3. Do students' hope and goal levels for STEM education differ by their awareness of STEM education?

Method

This research was conducted in the descriptive survey model as one of the quantitative research methods (Büyüköztürk et al., 2013).

Data Collection Tools

Developed by Douglas and Strobel (2015) and adapted into Turkish by Yaman et al. (2019), the “*Hopes and Goals Survey for K-12 STEM Education*” scale and demographic information form were used in this study. The reliability level of the scale, which consists of 18 items and 4 factors, was 0.86 for the EFA sample and 0.87 for the CFA sample.

Study Group

The study group of the research consists of 102 students at the 6th, 7th, and 8th-grade levels. The demographics of the participant students are given in the table below.

Table 1. Demographics of the students

Variable	Classification	f	%
Gender	Male	26	25.5
	Female	76	74.5
Grade	6	30	29.4
	7	30	29.4
	8	42	41.2

Table 1 shows that there are more female students in the group. However, in terms of grades, there is a more balanced distribution.

Data Analysis

The Kolmogorov-Smirnov test suggested that the data were normally distributed ($p > .05$). For this reason, parametric tests were used in the analysis of the data. In this context, descriptive statistics and independent samples t-test were used in the analyzes made within the scope of the research.

Results

The frequency and percentage values of students' STEM career preferences are shown in Figure 1.

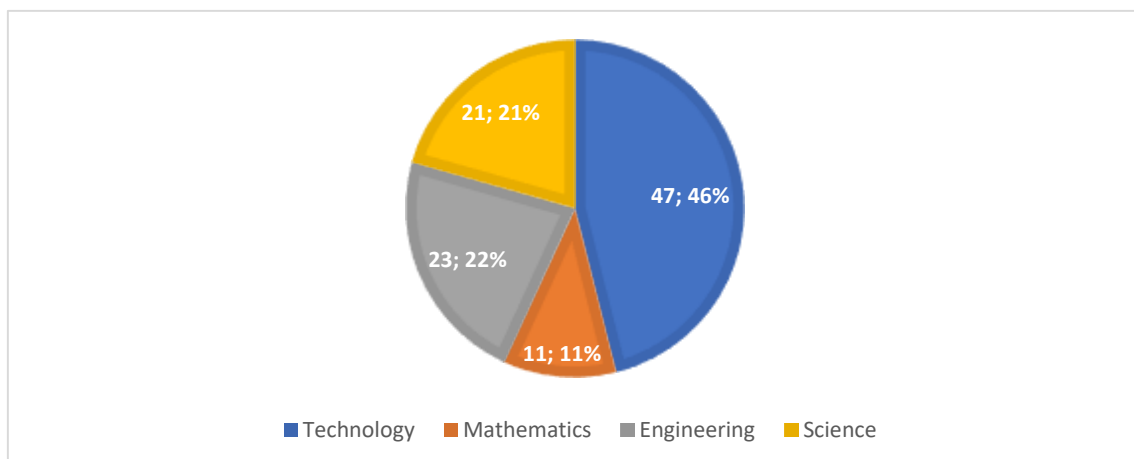


Figure 1. Professional tendencies of students regarding STEM disciplines

Figure 1 indicates that approximately half of the students have a professional tendency toward the field of technology. Science and engineering fields have values close to each other. Mathematics is the least preferred field.

Independent samples t-test results of students' hope and goal levels for STEM education by gender are shown in Table 2.

Table 2. Independent samples t-test results of hope and goal levels for STEM education by gender

Gender	N	\bar{X}	S	sd	t	p
Female	76	63.54	10.86	100	1.505	0.136
Male	26	59.46	14.67			

Table 2 suggests that the scores of females ($\bar{X}=63.54$) are four points higher than those of the males ($\bar{X}=59.46$). However, there is no significance between this score difference ($t_{(100)}=1.505$, $p>.05$).

Table 3 shows the independent samples t-test results according to the students' hope and goal levels for STEM education and their awareness of STEM education.

Table 3. Independent samples t-test results of hope and goal levels for STEM education
according to awareness of STEM education

Gender	N	\bar{X}	S	sd	t	p
Unaware	88	61.06	11.48	100	3.178	.002
Aware	14	71.57	11.60			

Table 3 points out that the scores of those who are unaware of STEM education ($\bar{X}=61.06$) are significantly lower than those who are aware ($\bar{X}=71.57$) ($t_{(100)}=3.178$, $p<.05$).

Discussion and Conclusion

This study examined students' hope and goal levels for STEM education. The literature highlights that the studies in this field are limited. In addition, it is notable that these studies are generally in the form of scale development/adaptation (Douglas & Strobel, 2015; Timur et al., 2022; Yaman et al., 2019).

The first result obtained from the research is that the majority of the students' professional goals are in the field of technology. This result may be due to the attractiveness of the large market in the software industry. There are studies with similar results in the literature (Karakaya et al., 2018). However, some studies also reported adverse results (Bozkurt Alan et al., 2019; Kurt, 2019).

Additionally, the hope and goal scores of female students for STEM education are higher than male students. However, there is no significance between the scores. Timur et al. (2022) also reached a similar conclusion in their study. According to Karakaya et al. (2018), on the other hand, female students are more interested in STEM professions than males. However, contrary to this result, there are studies showing that men have higher

interests (Christensen & Knezek, 2017; Sadler et al., 2012).

When the hope and goal scores for STEM education were examined by students' awareness of STEM education, it was concluded that those who were aware of STEM education had a significantly higher average score than those who were unaware, which is an expected result. As a matter of fact, students who are aware of STEM education are expected to score higher than other students.

Suggestions

The number of studies with different methods, sample sizes, and qualities for the hopes and goals of STEM education must increase in the future.

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